



Estimates of illegal and unreported seafood imports to Japan



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ABSTRACT

An investigation of illegal and unreported fishing in source countries indicates that 24–36% of 2.15 million tonnes of wild-seafood imports to Japan in 2015 were of illegal and unreported origin, valued at \$1.6 to \$2.4 billion, out of a total import of US\$ 13 billion. A supply chain case study of crab imported from Russia illustrates the intricacies of trade in illegal seafood products in this region. Weakly framed import regulations and outdated fisheries policies appear to be driving an inadvertent trade of illegal and unreported seafood products into the Japanese market. A multilateral approach could extend the strict requirements for food safety to the country of origin and provide more complete supply chain traceability for all commercial seafood species imported by Japan.

1. Introduction

Illegal, Unreported and Unregulated (IUU) fishing poses a significant problem to the sustainable management of fish stocks worldwide. With 58% of global fish stocks fully utilized and 31% exploited at unsustainable levels, IUU fishing practices can have a major impact on food security, livelihoods and economic growth in developing countries [1]. With several changes in international policing [2] and, recently, the implementation of the FAO Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (PSMA) in 2016 [3], trade measures to improve traceability and catch documentation deserve more attention than ever before. Opaque supply chains can mask IUU activities [4] and have motivated the need to not only understand where illegal fishing takes place but also how such products enter the global market place. To supplement shortages in domestic production, developed economies outsource processed fish in large volumes from other countries each year. Sourcing practices in the principal seafood market states such as USA, Japan and EU can have rippling effects on management practices in developing countries. The need for market state responsibility to control IUU trading practices has already captured the attention of policy makers in both the USA and EU. Previous studies have shown that as much as 20–32% of seafood imported by USA is of IUU origin [5]¹, and measures within the USA to improve this situation have already been implemented [6]. To increase our understanding of the impact of illegal seafood trade on key market states, this paper provides estimates of the amount of illegal and unreported seafood imports to Japan, the third largest destination for

seafood consumed in the world.

Fish is soul food for Japanese citizens. For several centuries, several iconic dishes such as sushi and festivals such as “*Doyo no Ushi*” (eel festival), have been intricately linked to culture and cuisine in Japan. Seafood is an integral part of the Japanese culture and comprises more than 40% of animal protein consumed each year [7,8]. Over the past century Japan has dominated global seafood trade both through its fishing fleet (active in all major oceans and RFMOs) and through import of high value fishery products. Japanese cuisines such as sushi [9] have also expanded their appeal to other global markets. With loss of access to historic fishing grounds due to implementation of exclusive economic zones (under UNCLOS) by other coastal states [10,11], Japan has supplemented shortages in domestic supply over the past three decades through seafood imports [12–14] sourced from global trade. In 2009, up to 38% of seafood consumed in Japan was imported from other countries, rising to about 40% in 2015. [15]. A growing preference for meat coupled with a weakening yen have led to a decline in seafood consumption (from 61.2 kg per annum in 2005–27.0 kg in 2014: [16–18]). Nevertheless, Japan is still the third leading seafood importer in the world, importing 2.54 million tonnes of seafood valued at US\$ 13.8 billion in 2014 [19]. Concurrently, although import volumes have decreased, the value of imported products has surpassed past records [20]. Japan is also the world's largest market for high value species, importing 470,000 t of tuna every year [21]. High-value seafood imported by Japan includes fresh and frozen tuna, shrimps, salmon, crabs and eels. This high import rate makes Japan vulnerable to the inadvertent import of illegal seafood products and any major destination

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market for illegal seafood will be a significant source of revenue for illegal fishery operators and organized crime.

2. Methods

2.1. Scope of the analysis

This study is focused on estimating volume and value of illegal and unreported seafood products imported entering Japan. Similar to previous studies [22], the estimates in the current study do not cover “unregulated” fisheries or seafood products landed by Japanese flagged vessels in domestic ports. Furthermore, the current study does not look at IUU fishing within domestic fisheries of Japan. Finally, the work looked only at edible wild seafood imports of marine origin, and excluded the following products: (a) farmed species, (b) freshwater species, (c) ornamental fish, (d) frozen fillets of mixed species, and (e), fishmeal for pet food. Processed products such as prepared foodstuffs that utilized multiple species of a similar texture and colour, thus masking the identity of the actual species were also excluded from this analysis.

2.2. Estimation methods

The analysis depends on knowing the amount and constituents of seafood imported into Japan, the proportion that derives from wild caught fish and the provenance profile of these imports by country and region. In the first phase, trade flow analysis was used to understand the proportion of wild seafood caught by exporting countries within their own EEZs as well as imports from other countries through the reprocessed trade. Afterwards, the proportion of illegal and unreported fish through all the points in the supply chain from the exporting country were estimated for products exported to Japan. Japanese Customs and Trade data does not differentiate between wild caught and farmed species, so interviews with suppliers provided additional information for this assessment for the top 9 countries exporting to Japan. As many of the product codes in Japan Customs import trade data lacked details of species and source countries, 36 interviews were conducted with port officials, customs agents, traders, seafood companies and regional trade experts in each of the top 9 exporting countries to identify sourcing patterns for the 27 products (Table 1). For example, 77,000 t of squids and cuttlefish imported by Japan from China were sourced from multiple jurisdictions and were either caught by Chinese vessels or imported from other countries. Similarly, the majority of the tuna exported by Thailand to Japan was itself imported from various Asia-Pacific countries, only a small quantity being caught by Thai fleets.

Three alternative trade flow scenarios, increasing in complexity and used in the analysis are depicted in Figs. 1–3. All 27 products from the top 9 countries in the current study fall under one of these three trade flow scenarios. IUU risk for each of its sub-categories (e.g., X%(IUU), Y%(IUU), Z%(IUU) or RPT%(IUU)) contribute to aggregated IU risk for each product. Upper and lower percentage estimates were assigned in each case, so that uncertainty can be fully expressed in an envelope or percentage values for the final results. For example, in the case of sea urchins from Russia, which fall under trade flow scenario 1, the percentage of illegal and unreported fishing is calculated based on various IUU infractions committed by Russian fleets catching sea urchins within the Russian Far East EEZ. On the contrary, in the case of tuna exported by Thailand to Japan, a majority of the exported volumes originated from reprocessed tuna imports by Thai companies from other Asia-Pacific countries. In this case, the illegal and unreported risk for various categories of fleets is aggregated for both Thai fishing fleets and imported tuna from other countries rendering this import and example of trade flow scenario 3. Discrepancies associated with batch mixing of legal and illegal catches in the processing streams in Thailand [23] as well as checks on import documentation and inspections at ports in Thailand also contributed to the overall IUU risk envelope for such products.

Table 1
Estimates of 27 wild-caught seafood products selected from top nine countries for the IUU Seafood Imports Analysis.

	Country	Products	Quantity imported in 2015, (tonnes)	Value, US\$
1.	South Korea	Bigeeye tuna	9271	98,400,157
		Spanish mackerel	1560	8345,785
		Skipjack tuna & Bonito	612	807,669
2.	China	Squids & Cuttlefish	77,000	320,071,760
		Eels	18,138	389,386,884
		Shrimps ^a	8147	75,089,566
		Tuna	7675	69,129,305
3.	Russia	Salmon	32,553	175,498,157
		Crabs	14,941	227,016,033
		Sea Urchins	7994	49,893,132
4.	Chile	Fishmeal	17,675	36,150,876
		Sea Urchins	1922	65,702,033
		Toothfish	147	2223,760
5.	Thailand	Squids & Cuttlefish	10,973	102,732,735
		Shrimps ^b	3568	37,858,776
		Tuna	2420	14,065,876
6.	USA	Alaska Pollock	122,280	344,952,165
		Salmon	22,065	114,426,537
		Crabs	6501	113,325,446
7.	Indonesia	Skipjack Tuna	28,471	76,524,330
		Shrimps ^c	15,368	172,355,824
		Tuna (YFT, BET, SBT)	7491	63,171,049
8.	Vietnam	Shrimps ^d	15,000	170,894,191
		Squids & Cuttlefish	6289	45,169,380
9.	Taiwan	Bigeeye tuna	36,434	217,989,066
		Yellowfin tuna	18,022	73,892,082
		Eels	3275	74,397,429
Total			495,792^e	3139,470,003

^a 56% of shrimps exported to Japan were of wild origin, and Chinese companies also imported shrimps from other Asia-Pacific countries for trade as reprocessed product.

^b According to industry sources, only 10% of the Thai shrimps exported to Japan were of wild origin.

^c Interviews with seafood exporters and government agencies in Indonesia suggested that about 47% of shrimps exported to Japan were of wild origin.

^d Information from seafood traders in Vietnam suggested that 30% of Vietnamese shrimps exported to Japan were of wild origin.

^e 495,792 t were worth 374,437,645,278 Japanese Yen and 3139,470,003 US dollars.

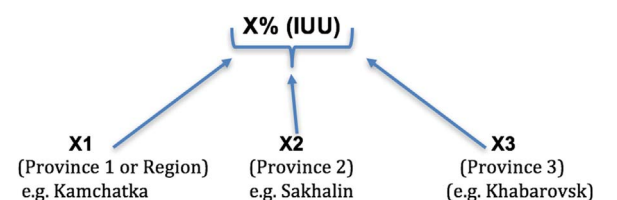


Fig. 1. Trade Flow Scenario 1 Species caught within the Exclusive Economic Zone (EEZ) of the exporting country.

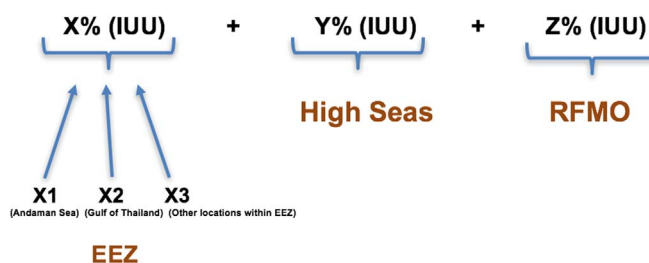


Fig. 2. Trade Flow Scenario 2. Species caught within EEZ, High Seas and RFMO waters by fishing vessels flagged to the exporting country.

2.3. Estimation of seafood imports to Japan

In 2014 Japan, USA and EU were the top three seafood importers in the world taking 59% by quantity and 63% of value [24]. In terms of international seafood trade, Japan and USA each had a share of 14% in

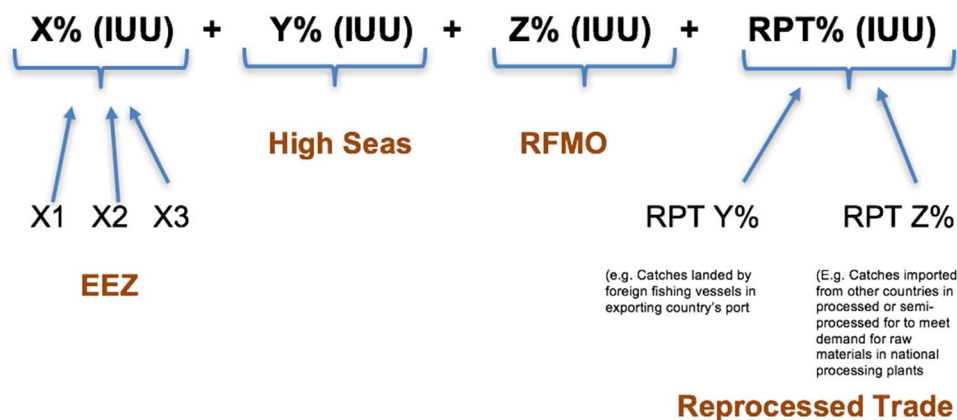


Fig. 3. Trade flow scenario 3. Species caught within EEZ, High Seas and RFMO waters by fishing vessels flagged to exporting country; and reprocessed trade imports which include raw materials sourced from foreign fishing vessels and frozen seafood imported through reefers and container shipments from other countries (e.g., Thai tuna).

Table 2

Top 10 seafood products imported by Japan in 2015 (Source: Global Trade Atlas, 2016).

Rank	Top 10 Products imported by value in 2015
1	Frozen Shrimps and Prawns
2	Preserved/Prepared Shrimps and Prawns
3	Frozen Skipjack/Stripe-bellied bonito tuna fillets
4	Frozen Fish Meat
5	Frozen crabs (shell-on)
6	Frozen Fish Fillets
7	Frozen Pacific Salmon
8	Frozen Fish
9	Preserved/Prepared Fish
10	Frozen Bigeye Tuna, livers and roes

2012 while the EU took 36% [25]. In 2015 Japan imported wild seafood from 109 countries (127 if freshwater and ornamental fish are included [26]) but the top 9 countries accounted for approximately 60% of wild seafood imports to Japan by volume (China, United States, Chile, Thailand, Vietnam, Russia, South Korea, Indonesia, and Taiwan: see Tables 1, 2) [27]. Total seafood imports to Japan in 2015 were 2148,489 t valued at US\$ 13 billion. Separation of Customs import data by wild and farmed species by volume suggests that approximately 52% of the total imports were of wild capture origin. So, out of the 2.1 million tonnes of total seafood imports, about 1.1 million tonnes were of wild origin. Extrapolating 1.1 t of marine wild catch, the 27 products evaluated in this study (495,792 t) represented about 44% of Japan 2015 wild-caught seafood imports by volume.

Currently, inspection of cargo is dependent on Cargo Declaration forms submitted by the importer. In the absence of mislabeling and DNA studies, the Japanese Customs Agency has limited means to cross-check the information for species, value and product type using labels on imported seafood. It is also difficult to understand who determines the value of imported seafood, i.e., Japan Customs or the seafood importer company. Further, another discrepancy that was noticed with Japanese trade data was the lower value for products listed on Japan Customs Statistics in comparison to value of similar products sold in the domestic market and from international trade data. This might suggest that a lower value is declared to reduce import taxes due to gaps in the existing trade regulations within Japan.

Only 3% of total seafood was imported through air cargo, with 75% arriving through container ships and 20% through reefers into Japanese ports. Government agencies informed us that the percentage of direct seafood imports through foreign fishing vessels into Japanese ports is very low. In Japan, there are 6 wholesale seafood markets (Tokyo, Nagoya, Osaka, Kyoto, Kobe and Yokohama) and 166 ports for seafood import trade, and distribution is well documented [28]). In 2014, 47.8% of seafood was distributed through Foodservice, 35.1% through Retail and 17.1% through Institutional channels in Japan [29]).

Evaluating the legality of imported products is often fraught with

difficulty when management regimes do not require end-to-end traceability for seafood imported through global supply chains. In the current study, a point estimate to evaluate illegal and unreported catches for the year 2015, based on the model described in [30] was used. The method uses the “anchor points and influence table” technique [31] to calculate IUU catches for products caught by a country's fleet within its EEZ and the high seas. In the current study the same method was adopted for estimating IUU catches for products imported by Japan. The former method is better suited for analyzing IUU product flows in U.S., Japan and EU markets where seafood is mainly procured from global supply chains, while the Agnew et al., method [32] is more appropriate for estimating IUU catches within a country's EEZ. The estimation methodology for the current study is improved, and is more robust, by including the three IUU trade flow analysis scenarios (Figs. 1–3) depending on whether the product is sourced by the exporting country through domestic or foreign flagged vessels within its EEZ or when seafood is procured from other countries through reprocessed trade within the supply chains.

2.3.1. Estimation of illegal fish imports

Estimates of total volume and value of illegal and unreported (IU) fish entering the Japanese market through wild seafood imports was evaluated using the following method, as illustrated in Fig. 4.

1. For each of the top 9 source countries for imports, the top two to three wild-caught seafood products (except for China – 4 products, and Vietnam – 2 products) by groups, species and volume were recognized which resulted in identification of 27 import streams. The species were identified based on preliminary data provided by Japan Customs Trade data and were further refined through cross-checks with customs data and the interviews in 9 exporting countries mentioned above. In some cases, where the Japanese Customs HS codes (see below) failed to provide details on species (*Paralithodes camtschaticus*) or groups (e.g. *Sea Urchins*) such products were excluded from the analysis. Since the trade data for Asian shrimps do not categorize between wild and farmed shrimp, interviews with traders in China, Thailand, Indonesia and Vietnam provided evidence to estimate the proportion of Japanese imports that were of wild origin in each case.
2. For each of the 27 countries and product combinations, originating fisheries were identified using interviews, trade data and published literature and the appropriate trade flow scenario chosen. Due to the complex nature of seafood procurement in each country sourcing fish from both EEZ, High Seas and other countries no precise definition of ‘fishery’ was used. Fishery sources were identified using a combination of vessel flag, geographical location, duration of fishing season, open or quota fishery, target species and gear types, etc.
3. Information regarding illegal and unreported (IU) practices was collected and analyzed for the 27 country/species combinations and

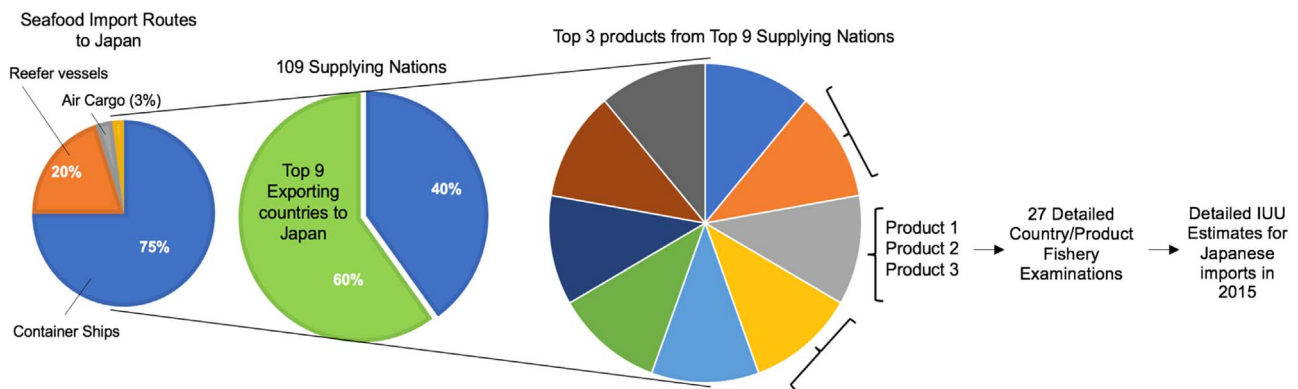


Fig. 4. Methodology diagram: estimating wild seafood IUU imports into Japan.

their source fisheries. Based on number of points in the supply chain (single to multiple locations within EEZ, imports and the source fisheries, batch mixing in processing plants, etc.) multiple data sources including interviews were used to estimate quantitative estimates of IU fishing.

- Using data from multiple sources and the statistical method of “anchor point and influence” approach a range of IU estimates were derived using upper and lower approximate 95% confidence intervals for each of the 27 products for top 9 countries. The IU ranges derived for each product were then pooled to produce a trade-weighted average for the 27 country/species product groups. A detailed explanation of the “anchor point/influence method” for estimating IUU catches in global seafood trade is provided in [33].
- The 27 country/product groupings accounted for 44% of wild-caught seafood imports to Japan broadly representing illegal and unreported (IU) levels across all import categories. The total IUU figure for the whole set of imports was then calculated using linear extrapolation.

2.3.2. Data and information sources

In addition to the sources utilized in the earlier study on USA seafood, three additional sources of data support were utilized in the current study:

- Firstly, in the preliminary phase a much more detailed ground-truthing of available import data from Japan Customs, Rabobank and the Global Trade Atlas was used to strengthen the breakdown of seafood import data.
- Field visits to key fishing ports helped to understand supply chain and import procedures in Japan. Consultations with academics and other regional industry experts provided additional layers of information on supply chain dynamics.
- Finally, discussions with Government Ministries aided in data discovery, understanding of the scope of the inspection regime and the categorization of wild-seafood under various commodities.

More than 312 different data sources were utilized including academic papers, Government reports, fisheries association reports, NGO publications, databases, seafood industry audit reports, consulting reports, tuna RFMO publications and press reports. In addition, interviews were conducted with academia, traders, government officers, port officials and private seafood industry individuals to evaluate the breadth of illegal and unreported fishing in each source fishery over the entire year. In the beginning of the study 9 regional fisheries experts working on IUU fishing were also consulted before collection of data to understand the ground situation in source fisheries. In several cases where data collected from interviewees was of a sensitive nature, it has been cited as anonymous within the current work. Interviews with Government officials were particularly helpful for data-poor fisheries

where conventional published literature is lacking in many developing countries. A total of 36 interviews were conducted in the top 9 exporting countries as part of this study. A small percentage of the data sources also included confidential government reports of audits of the fisheries industry, and these were particularly helpful in adjusting the IU ranges for the 27 products. Further details of the data sources are described in [Supplementary information](#).

2.4. Obscurity of HS codes

Japan and USA are perhaps the only two countries in the Asia-Pacific to use an eight digit Harmonized Commodity Description and Coding System (HS) to categorize traded products for Customs statistics. Moreover, less than 40% of the seafood products in Japanese Customs data give information about species, with most of the HS codes in Japan providing details on generic product types such as abalone, salmon, squids, etc. Furthermore, most customs codes in exporting nations (excluding USA) utilize six-digit HS codes, so it was necessary to cross-check products exported from the top 9 countries using interviews with traders, seafood companies, fisheries officials as well as port and customs records to identify country of origin and species specifics for the 27 products evaluated in this study. Further, due to limited disclosure on seafood buyers and trading practices in Japan, interviews were conducted in the nine exporting countries to identify commodity supply chain routes through air and sea to Japan. Interviews in exporting countries were also helpful in identifying whether products were directly sourced through domestic fleets within the exporting country itself, or whether such products were sourced from other countries through the reprocessed seafood trade. To analyze import routes into Japan from top 9 countries, vessel traffic was analyzed using AIS signals for container and reefer vessels while Japan Customs data was used for analysis of seafood imported through air cargo.

3. Results

The top 2–4 wild caught seafood products for each of the top 9 countries that exported to Japan in 2015 comprised nearly 0.5 million tonnes (Table 3) and were valued at US\$ 3.1 billion. In summary, results from the current analysis of wild-caught seafood imports to Japan suggest that 24–36% by weight of seafood imported in 2015, with a value ranging from \$1.6 billion and \$2.4 billion were sourced from illegal and unreported (IU) catches. This figure indicates that the quantity of IU fish entering Japanese market is similar to the illegal seafood entering USA (20–32% by weight). Indeed, results from current study fall close to the estimated global IUU average of 13–31% [34].

Of the 27 country-product groupings examined in the current study, squids and cuttlefish from China had the highest estimated volume of illegal and unreported origin (26,950 t to more than 42,350 t, representing 35–55% of total squid imports from China). Alaska Pollock

Table 3

Estimated illegal and unreported (IU) catches for 27 seafood products exported in 2015 for the top 9 countries (in tonnes and % by weight). Column 2 shows the estimated trade-weighted average for 2–4 species assessed in the present study for each country. The two right-most columns have estimates of illegal imports to Japan in tonnes.

Country	Average estimated % of IU catches	IU Catches range by product (%)	Product	2015 exports to Japan (t)	IU Catches (t)		
					Lower limit	Upper limit	
South Korea	16–24	20–30	Bigeye tuna	9271	1854	2781	
			Spanish Mackerel	1560	156	265	
			Skipjack tuna & Bonito	612	104	153	
China	36–57	17–25	Squids & Cuttlefish	77,000	26,950	42,350	
			45–75	Eels	18,138	8162	13,603
				Shrimps	8147	3259	4888
				Tuna	7675	1995	2840
				Salmon	32,553	9766	13,021
Russia	25–36	17–25	Crabs	14,941	2540	3735	
			Sea Urchins	7994	2158	3597	
			Fishmeal	17,675	7070	9721	
Chile	24–35	16–27	Sea Urchins	1922	307	519	
			Toothfish	147	23	32	
			Squids & Cuttlefish	10,973	2743	3840	
Thailand	24–35	25–35	Shrimps	3568	892	1320	
			Tuna	2420	508	726	
			Alaska Pollock	122,280	18,342	26,901	
USA	12–20	15–22	Salmon	22,065	2206	4413	
			Crabs	6501	650	1170	
			Skipjack tuna	28,471	5694	9110	
Indonesia	23–32	20–30	Shrimps	15,368	4610	6147	
			Tuna (YFT, BET, SBT)	7491	1348	1873	
			Shrimps	15,000	5250	7500	
Vietnam	32–50	30–50	Squids & Cuttlefish	6289	1886	3144	
			Bigeye tuna	36,434	8380	14,573	
			Yellowfin tuna	18,022	3965	5406	
Taiwan	22–35	23–40	Eels	3275	720	1146	
			22–30				
			22–35				
Total	24–36% (weighted average)			495,792	121,538	184,774	

from USA was second with volume of more than 26,000 t (15–22% of Pollock imports from USA). Wild caught salmon from Russia was the next highest illegally imported product by volume (13,000 t, denoting 30–40% of salmon imports from Russia). This was followed by bigeye tuna from Taiwan (representing 23–40%), Eels from China (45–75%) and fishmeal from Chile (40–55%). Other seafood imports with a higher IU average than 24–36% include squids and cuttlefish from Vietnam (30–50), sea urchins from Russia (27–45%) and shrimps from the following countries (Vietnam (35–50%), Indonesia (30–40%), Thailand (25–37) and China (40–60%). On the lower end, Spanish mackerel from South Korea (10–17%), crabs from Russia (17–25%), toothfish (16–22%) from Chile, salmon (10–20%) and crabs from USA (10–18%) and Yellowfin tuna from Indonesia (18–25%) had an estimated IU amount of less than 24–36%. Shrimps and tuna comprised the bulk of imports by weight into Japan. Although shrimps represented a higher percentage of imports, much of it was of farmed origin and was excluded from the analysis for Thailand, Vietnam, Indonesia and China.

4. Discussion

The globalized nature of seafood procurement in Japan is characterized by imports of commodities through bulk shipments from container ships where it is often difficult to identify illegal seafood and fish of mixed origins. Due to lack of regulations to trace back imported seafood, the existing import control system in Japan poses very little deterrent to the entry of illegal seafood. For processed fish imports, seafood demand can also be gauged through the low import tariff rate of 9% in Japan, compared to 16% in the EU and 20% in USA [35,36]. In the absence of reliable traceability systems and enforcement capacity, countries in the developing world often certify and export products without adequate provenance. Seafood moving through processing and reprocessing countries such as China, Thailand and Vietnam pose more problems in this context [37]. Although new IUU export-import regulations such as the

U.S. Seafood Import Monitoring Program and EU – IUU Regulation 1005/2008 pose administrative hardship on developing countries, such measures can have rippling benefits for all compliant nations involved in the legitimate trade.

Some of the regulations relevant to seafood imports in Japan include Food Sanitation Act, Law Concerning Standardization and Proper Labeling of Agriculture and Forestry Products (JAS law), the Customs Act and the Foreign Exchange and Foreign Trade Act. An outdated seafood import policy within a globalized commodity market is bound to affect Japan's influence and reputation on the global stage. To ensure long-term supply of legally caught fish from developing countries, market state responsibility in mandating import control inspection and documentation needs to be reinforced in all the key seafood market states of (Japan, USA and EU: [38]). Country of Origin Labeling (COOL) can aid in food safety and better understanding of supply chain routes for both consumers and regulators in Japan. By seeking traceability at all stages of the import supply chains for commercially important species such transparency can be achieved. Interviews with traders in 9 exporting countries in the current work revealed a disturbing trend that it is well known that exports to Japan do not require the same provenance documentation as the EU or USA. Indeed, most import rejections in Japanese trade have been related to food safety (microbial contamination) and the presence of banned antibiotics or drug residues in farmed products [39], rather than the determined legality of imported products.

Information on seafood supply chains and sourcing patterns are sensitive matters depending on culture, norms and industry practices in different countries. Japan is one such key market where often very little information [40] on importers and the origin of seafood is communicated to the public [41]. In contrast to U.S.A. and EU markets, Japanese consumers are more sensitive about freshness of the products [42] and may display more trust for domestic seafood than for imported fish [43]. Traditionally, apart from tuna, few imported seafood products could compete with seafood landed by Japanese fishing vessels

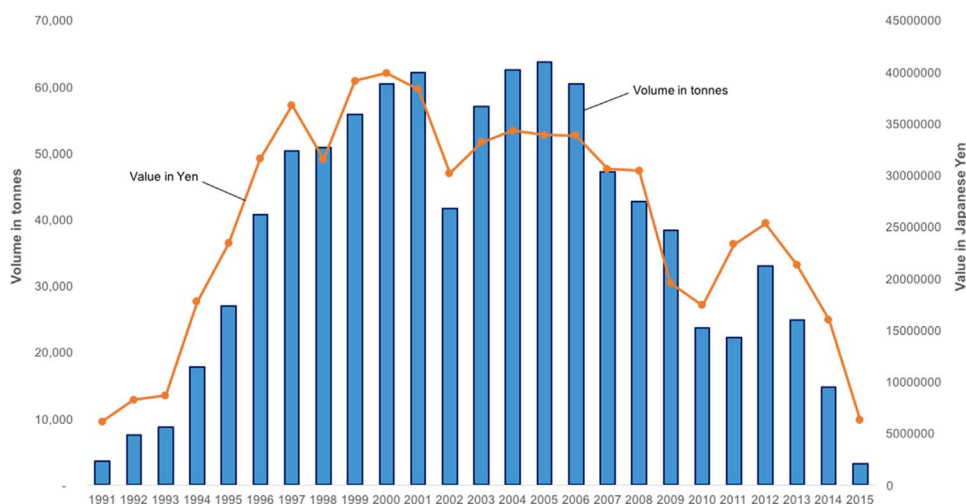


Fig. 5. Russian crab landings in 14 Hokkaido Ports – Northern Japan (Source: Trading Statistics, Ministry of Finance, Japan).

[44]. Field visits to local markets in Tokyo and Hokkaido during the present study revealed that Japanese consumers have affinity for some iconic species like skipjack tuna, bigeye tuna and eels. Traders also expressed support for policy interventions in trade of shared fish species and illegal imports that might affect national security interests of Japan in the wider Asia-Pacific region. However, growing competition with foreign fishing vessels [45] and import of cheaper seafood from overseas also led to a steep decline in profits for Japanese fishermen [46]. Import of farmed salmon from Chile and Norway can be cited as one such example [47]. In recent years, a decline in salmon catches from the Japanese EEZ has also contributed to an increasing dependence on imports of farmed fish. On the positive side, recent studies in Japan have shown that consumers are willing to pay a higher price for eco-labeled seafood products [48]. Since there are no market-based studies to verify the accuracy of labeled products, DNA analyses [49] can provide additional oversight for mislabeled products sold in Japan. Mislabelling is known to have major implications for IUU seafood products entering the supply chain [50].

4.1. Seafood traceability in Japan

Japan does not adhere to the same IUU traceability standards as the USA [51] and Europe [52] because product verification measures are not embedded in its trade and import regulations [53]. Although a limited catch documentation scheme is implemented for Bluefin tuna, Russian crabs and toothfish, such arrangements do not apply to bulk of seafood imported from other countries. The current seafood import system in Japan relies on transparency of global supply chains that often do not use the same traceability standards as the EU and USA [54]. As Kerr [55] aptly notes “A lack of relevant data is the single most significant difference between Japan’s democracy and the democracies of the West”. During the current study the authors also found it very difficult to gauge the Japanese Government stance on trade of IUU fishing products, getting access to data on seafood trading practices in Japan, and compliance with the Port State Agreement [56]. Under current Japanese regulations, it is not mandatory to keep records of seafood traceability for imports [57] and there is very limited disclosure [58] from Government agencies on seafood trading or sourcing practices. Although Government (Ministry of Health, Labour and Welfare) and industry associations have developed guidelines and a limited traceability system for shellfish and farmed products [59], such requirements do not extend to vast majority of its wild seafood imports [60]. Several seafood businesses also operate a limited traceability through one step-back and one-step-forward approach for seafood products sold locally but this arrangement does not extend to source countries from where the products are procured.

Although the volume of direct seafood landings by foreign fishing vessels at Japanese ports is comparatively low it has consistently been flagged during the current study by interviewees that foreign fishing vessel landing declarations are more likely to be inspected for documentation checks by Customs than Japanese fishing vessels landing similar species in Japanese ports. Moreover, supply chain procurement and distribution are shrouded in secrecy. In addition to a lack of clear strategy to curtail illegal fishing, Government agencies in Japan are reluctant to release information on entry and exit of foreign vessels into Japanese ports. Furthermore, in comparison to Western countries, the IUU policy in Japan is driven by the seafood industry and politicians in the ruling party rather than by independent Government agencies. Japanese seafood importers are also reluctant to share information on their sourcing practices for seafood bought from foreign countries indicating low transparency and traceability problems.

4.2. Russian crabs and the impact of an IUU crab agreement on the Japanese market

The Far Eastern waters (RFE) of Russia are one of the most productive waters on the Russian continental shelf contributing immensely to state revenues through export of several high value species such as salmon, pollock and crabs (see Fig. 5). These prolific fisheries have often attracted poaching on a massive scale by both Russian and foreign firms [61]. Since the fall of the Soviet Union in 1991, access to low-cost poached seafood from Russia has seemed to be integral part of the regional trade within the Asia-Pacific region [62]. RFE has also been a hotspot for illegal fishing with 90% of illegal fishing detentions in the Russian EEZ coming from this region (Table 4, [63]). Trade data reveals that over the past two decades Japan has openly imported illegal seafood in large volumes from Russian waters [64]. Organized crime groups are also alleged to be involved in illegal seafood trade on both Russian and Japanese sides of the border [65]. Industry sources in Japan stated that access to cheap stolen products from Russia has significantly influenced profitability for Japanese retailers and consumers. Since 2015, Russia has taken several legislative measures to try to control IUU fishing in the Far East [66] as well as signing IUU crab agreements with five countries: Japan, South Korea, North Korea, China and USA, that are the key market destinations for Russian crab. Over

Table 4
Russian Far East poaching data (Source: FECRS 2016).

% of total marine poaching cases related to seafood poaching in 2014	93.5%
% of criminal cases prosecuted under articles 253 and 256 of the Criminal Code of Russia in 2014	52%
Number of vessels detained in 2015	67

the past three years several Russian crab trawlers have moved to the Barents Sea further reducing pressure on the crab stocks [67].

4.2.1. Events preceding the implementation of Russian IUU crab agreement with Japan

Illegal crab fishing in Russian waters is estimated to be worth US\$ 700 million dollars each year [68]. Less than 10% of the total crab catch from the Russian Far East is sold in the Russian market while large volumes are exported to South Korea, China, Japan and USA [69]. Bilateral trade with China, South Korea and Russia constitute an integral part of seafood procurement systems in Japan. Prior to the 2014 IUU agreement, for several years Russia pursued a constructive dialogue with Japan to tackle landings of illegal crabs in Japanese ports. However, such meetings did not lead to reduction of illegal seafood landings at Japanese ports until 2016 year. Frustrated with continued landings of poached Russian crabs in Japan, the Russian Government announced that it would reduce the quotas for Korean and Japanese fleets operating in its RFE commercial fisheries if the IUU crab agreement was not implemented.

From the Russian Government's view, Japan seemingly imports a large amount of illegal seafood products creating a poor reputation for its coastal state responsibilities. However, when it comes to the Japanese Government viewpoint, the official stamps from genuine customs agencies are attached to the documents for products of Russian origin and the Japanese government is powerless to stop the import of illegal products. In other words, poachers and the customs authorities have likely been connected via collusion, and Russian border guards also get bribes to allow poachers to move freely. All in all, from the Japanese side, this problem is a Russian domestic problem and the responsibility for confronting IUU in Russia lies with the Russian Government. Consequently, the Japanese Government was reluctant to act on this issue. However, in November 2011 during the negotiations to determine quota in each country's EEZ, the Russian side took a hardline approach and said their Government will not reach an agreement on allocations of quota in each country with Japan if it is not supportive of Russia's policy to combat IUU fishing. It was at this juncture that Japan began to take a more cooperative attitude and signed the IUU crab agreement during the next year [70].

4.2.2. Emergence of Chinese and Korean ports of convenience

A Russian official declared that after the implementation of the Russian IUU crab agreement, since 2015, "three new supply channels opened up for poached crabs":

- (a) In the province of Shandong (China), the ports of Weihai, Shidao and Qingdao are used. Deliveries are made on a regular basis using transport ships equipped for transport of live crabs. South Koreans agree with the Russian side controlling illegal fishing operators where deliveries can be made, time, amount of crab to be unloaded, pay etc. Then the ship is sent to deliver crabs in one of the ports in Shandong Province. After reaching the designated area, handlers meet Korean partners and unload the cargo. Most of the crew on poaching vessels are usually Russian. Chinese sailors also present a Russian or Korean representative handler. For the hosts poaching vessels - Russian citizens -handlers tend to belong to the Koreans or Chinese.
- (b) Another delivery channel is through North Korea. Available information for the period from 1 January to 20 May 2015 shows that China imported at least 400 t of various illegal crab from North Korea (Kamchatka, blue, snow crab, hairy). As a rule, a poaching ship enters the port of Rajin (DPRK), unloads seafood, then the poached resources are exported to China. Some crab may remain for some time on the over-exposed basins in North Korea. All this crab is exported to Hunchun city (China), and is then distributed throughout China from there. The Chinese are engaged in this business in North Korea, and sometimes they used their handlers on

a poaching ship that is not docked at the port but reloading is always carried out in the waters of North Korea. Furthermore, unloading and shipping is carried out in China.

- (c) Thus, part of the illegal Russia crab products coming to China are imported directly through North Korea, generally using forged documents, although Russia and the DPRK have a bilateral agreement to fight IUU fishing, signed on 30.01.2012. In 2015, the Russian competent authorities have issued a certificate confirming the legality of the origin of 131.18 t of crab products, imported from the Russian Federation to the DPRK ports. In the 1st half of 2016 export statistics confirmed the legitimacy of the origin of 23.7 t of Russian production of crabs exported to North Korea. Meanwhile, China's import statistics in 2015 show that it received 1778 t of crabs from North Korea, although North Korea is not capable of catching so many crabs due to its largely obsolete fishing fleet. Also, crab illegally caught in Russian waters may enter China on ships flying the flag of a third country and such shipments are likely to be declared as products of other countries.

4.2.3. Impact of IUU regulatory measures on the Russian fishing industry

Unraveling the involvement of foreign companies in the illegal seafood trade requires exhaustive top-down investigation of the Russian fishing industry from state owned enterprises all the way to organized small-scale fishers operating in coastal fisheries and remote seascapes. Although notable, recent IUU controls by the Russian Government fail to capture the big picture as far as the illegal crab triangle of Japan, South Korea and China is concerned. This is said to be due to Russian Customs and trade statistics not capturing under-reporting by quota vessels, illegal transshipments and indirect landings in foreign ports using forged papers [71]. Involvement of organized crime and corruption among state agencies further convolutes this tricky condition [72]. There are also widespread allegations that recent claims of successful crackdown on Russian IUU crab trade were organized to seek certification and expansion of the crab business to USA and China while in fact illegal trade continues unabated on the sidelines [73].

4.2.4. Russian versus flags of convenience vessels

Flags of convenience (FOC) vessels landing crabs in Japan and Korea are alleged to have links with organized crime and such vessels operating in the Russian EEZ are largely owned by Russian, Korean, Japanese, and Chinese citizens [74]. The actual number of flags of convenience vessels in Russia is difficult to track, as this fleet is frequently upgraded through purchase of old schooners in Japan [75]. Murky foreign ownership of Russian quotas further convolutes this problem [76]. A majority of raw materials and semi-finished seafood products from the Russian Far East are transported by foreign vessels to neighbouring countries [77]. Although FOC vessels are involved in illegal crab trade they are not exclusive parties in this illicit trade with neighbouring countries. In the Russian Far East, a wide range of stakeholders and fishing fleets are involved in harvesting, transport and illegal trade of crabs. Often this strategy has involved both Russian and FOC vessels with modus operandi of each party changing by location within the eight federal districts in the Russian Far East [78]. Although the crackdown on the IUU trade of crabs has diminished direct illegal crab deliveries from Russia to Japan since 2016, export of illegal seafood has continued through vessels routing such catches into regional (incl. Japan) and global markets through Chinese and Korean ports [79].

Trade statistics reveal that China imported 3000 t of Russian crabs in 2015 while experts estimate the figure to be as high as 5000 t if illicit landings are included; similarly, China imported 1778 t of crab from North Korea although less than 131 t was officially imported by North Korea from Russia (Anon 2016d). In fact, the supply of poached crab under vessels flying flags of convenience ("third countries") is highlighted most often in the media as legal crab products imported through Russian companies that require a certificate confirming legality of

origin. One expert noted that in 2015, although one of the most popular systems among poachers to contravene Russian regulations remains the use of FOC ships under foreign flags, other methods to breach existing regulations are commonly used. These include declaring fewer quantities to customs, transferring under-reported contraband crabs onto foreign transport vessels at sea, and unloading undeclared crabs (or with forged documents) directly into a foreign port [80]. About 30 illegal crab boats were detained by the Russian Border Guard between Jan-Sept 2016 [81].

4.2.5. The present crab fishery situation (December 2016)

Interviews with Government, seafood industry people and trade experts in the Far East also indicate that recent press reports of a drastic reduction in illegal fishing on the Russian Far East are not trustworthy due to following six reasons:

1. The drastic decline in reported poaching cases is designed to seek seafood certification of high-value commercial species such as pollock, crabs and salmon;
2. although the Russian Border Guard reports signal a large reduction in poaching in the RFE, a radical transformation in either border guard fleet detentions or modus operandi of illegal operators has not been documented at sea or at the quayside and there are believable reports of illegal catches continuing to be diverted to Korea and China;
3. a new trend has also emerged in the last 7 years wherein most of the illegal fishing risk is assigned to flags of convenience vessels, while portraying a lower IUU risk for Russian vessels operating in similar fisheries;
4. there is low domestic demand for high volumes of crabs, sea urchins and salmon produced in the Russian Far East as domestic markets in Russia cannot absorb surplus volumes after the crackdown in Japan due to high value and the low purchasing power of Russian consumers;
5. although crab export is effectively negotiated by bilateral IUU agreements at the governmental level and all trading countries have been informed about individual crab quotas of Russian companies in real time over the past three years, dual parallel markets have emerged for poached crab; one where legal crabs with official documentation are landed in main Chinese ports, while a secondary stream of illegal poached crab deliveries are also accepted for global trade and domestic consumption within China. Data on these illegal deliveries is not captured in the official trade data or Customs statistics;
6. licensed crab boats in Russia are also confronted with a growing popularity for crabs and there are credible reports of the open sale of poached crabs in border cities such as Hunchun City in China.

The fact that a supply of illegally caught Russian crab to Japan continues, albeit in small volumes, is validated by the fact that sales of Russian hairy crab, including live crab, were observed by Japanese traders in Sapporo fish market in 2015, although official export figures from Russia to Japan reported no such imports in 2015. In 2014, Japanese official data on imports from Russia of live hairy crab during January-August showed zero, while in fact 928 t of Russian hairy crab were received by Japan. This has led some experts to believe that a small consignment of Russian king and hairy crabs imported to Japan also carried snow crab, which is drawing less attention. There are substantial differences in price among all these species of crabs. In 2014, the average price of imports of Russian king crab (Kamchatka and Blue) was 1527 yen/kg, snow crab (*Opilio, Bairdi, Angulyatus*, etc.) – 540 yen/kg, and hairy crabs, 1197 yen/kg. For the first quarter of 2015, the average price of king crab was 1958 yen/kg, while snow crab was 1640 yen/kg. During the first eight months of 2015 the average value of live king crab (king and blue) supplied by Russia was 1290 yen/kg, and snow crab (including *opilio* and *Bairdi*) was 1310 yen/kg. This

information proves that the problem of illegal deliveries of poached Russian crab has not yet been fully resolved, although it is encouraging that the extent of its activity seems to have declined considerably [82].

However, one Government official in Russia was optimistic that the recent decline in export of poached crabs to Japan might generate higher revenue for legal operators exporting crabs to Korea and the USA. Alternately, some traders in Hokkaido suggested to the authors that illegal import of Russian crabs would continue in lower volumes through Korea and China while direct landings from Russia to Japanese ports would end completely in the foreseeable future. Indeed, Russia is planning to introduce Electronic Veterinary certification from 1 January 2018 to enable importing countries to distinguish legal and illegal products originating from Russia [83].

5. Conclusions

Many of the recent developments in the import of seafood products to Japan have indirectly or directly been triggered by the 2016 FAO (UN) Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing. Evidence of the continued circumvention of some of these improvements reflects many of the practical issues in ensuring compliance with such international law in the face of inertia in the principal actors in the illegal seafood trade driven by huge profits [84].

End market consumers are often uninformed about implications of their buying habits on supply depletion and resource management in developing countries [85]. Globalized nature of seafood procurement often masks scarcity of depleted fish stocks in source countries [86]) and does not provide means to identify legal and illegal products sold through markets in the developed world.

This study indicates that Japan funds a significant portion of the global illegal and unreported fish trade by providing a market for such commodities. In 2015, an estimated 24–36% of wild caught seafood imports to Japan were of illegal and unreported origin valued between \$1.6 billion and \$2.4 billion. Due to a lack of documented provenance for imported fish and a tightening of the import regulations in the EU and USA, a lack of action could lead to the dumping of more illegal fish from other markets into Japan in future [87]. To achieve the ambitious goal of eliminating the sale of IUU products in the Japanese market there is need for more studies to evaluate the impact of unfair trading practices, mislabeling and imports of IUU seafood commodities on domestic seafood industry in Japan. A discourse with importers (e.g., wholesalers, retailers and supermarkets) is needed to identify key import commodities that need improved traceability measures in Japan. Secondly, there is a need to initiate dialogue (*'nemawashi'*) with Japanese policy makers to curtail import of IUU products through amendments to labeling and import documentation regulations. Thirdly, it is apparent from investigations in the work reported here that current Japanese border and import inspections are not geared towards preventing entry of illegal seafood products from global supply chains. Finally, there is a need for fundamental shift in fisheries policy acknowledging the fact that Japanese market is indeed vulnerable to imports of illegal seafood from other countries.

Due to lack of IUU traceability standards, current Japanese import trading system might be inadvertently facilitating import of illegal seafood. Even shipments from countries having a clean image can have poor documentation overshadowing the trade of IUU products [88]. Lack of control on illegal seafood imports is not a new problem in Japan as Russian import-export data has exposed imports of large quantities of illegal crabs from Russia over the past 3 decades [89] Furthermore, rising living standards in China, South Korea and Hong Kong have also generated a demand for larger volumes of seafood imports. Such imports often do not require documentation of provenance and this exacerbates the incentives to import illegal seafood, such as mislabeling, mixing of legal and illegal catches. These issues cannot be effectively tackled in isolation while countries such as China, Vietnam and

Thailand emerge as global processing hubs for seafood [90]. There is very little audit of processing streams in re-processing countries as audits in most developed nations have, until recently, mostly targeted food safety, and sanitary standards [91]. A recent proposal by USA at WTO to control illegal seafood imports by mandating detailed information on origin and source fisheries was by blocked by the Chinese delegation [92]. Such setbacks reveal that under current circumstances proactive measures to tackle illegal seafood imports on a global basis are likely viable only through individual actions on a country-by-country basis.

Current Japanese Customs codes and trade data do not provide a breakdown of farmed versus wild seafood, so Government agencies could offer stewardship by requiring such information from suppliers in exporting nations. There is an urgent need for reforms in the Japanese seafood procurement system as buyers in key market states often have better negotiating power due to huge volumes of trades each year. By implementing a traceability mechanism for key commercial species such as crabs, tuna and salmon, retailers can also play a critical role in controlling unfair competition from imported illegal products within the domestic market. Verifiable information on supply chain routes from point of capture to importing country through amendments to import regulations would bring an improvement in Japan, which currently reflects the world average of IUU activity. Improved record keeping and traceability for key imported seafood commodities could also improve the global standing of Government and seafood industry in Japan. In an increasingly global marketplace, Japanese regulators cannot afford to overlook measures undertaken by other key market states such as the USA where we have the U.S. Seafood Import Monitoring Program, and Europe where the EU has IUU Regulation 1005/2008. These fisheries regulatory instruments are increasingly used to ban seafood imports of illegal origin. It seems that Japan needs soon to accept the fact that current import regulations do not provide adequate means to prevent entry of illegal seafood imports [93].

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.marpol.2017.06.032>.

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